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Innovative Approach of USB Communication

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Abstract: ***The popularity of Universal Serial Bus (USB) storage devices is an indication of the computer user's need for a fast, large capacity and easily accessible system for data storage. The disadvantage of USB storage devices is that being a peripheral device, it needs a host, usually a Personal Computer (PC) to initiate and mediate communications between two USB storage devices. The USB slave to slave file transfer system seeks to create a bridge between two slave devices for file transfer when a computer is not available. The USB Slave -to-Slave File Transfer System (USS FiTraDev) utilizes USB controller to facilitate file transfers while smartphone is used as user interface .As we know almost 90 % peoples have smartphone because of its low cost but problem is that we cant exchange the data from one USB to another USB by using smartphone so to overcome this problem we have create this USS FitraDev device. We use smartphone as user interface and gives operation command from smartphone via Bluetooth .For communication between USB controller and smartphone we use Bluetooth module as mediator. We can copy single file, single folder or entire memory content from one USB to another USB. The system allows overwriting when a file of the same name is found in the destination flash drive. If the destinations USB don"t have sufficient memory space then it indicate the message "insufficient space" on smartphone display. Device uses two „A"sized alkaline batteries & also operate on AC supply.(by using adapter)***

Keywords: USB, Smartphone, FAT32, Display

1. Introduction

The popularity of Universal Serial Bus (USB) storage devices is an indication of the computer user's need for a fast, large capacity and easily accessible system for data storage. USB Slave to Slave File Transfer Device/ System is a device that can be used to initiate communication between (i.e. data transfer) two USB mass storage devices. For example, USB flash drive (Generally called Pen drive) in which we may have large amount of data & we have to copy this data into another flash drive then it can be possible using this small device which can be handled easily. As shown in the figure the user can transfer the data from source to destination. We can also able to select which folder is to be transfer with the help of user interface SMARTPHONE with Up-Down arrows & option & select buttons. Thus it makes the device more flexible. By addition of some extra software part it may be possible to the functions like delete, copy single file or folder. This device able to operate on batteries as well as on the AC mains power supply so that user can choose any alternative for his use depending upon the situations.

2. Relevance

As the development of USB enabled peripherals increases, the Universal Serial Bus (USB) has rapidly become a de facto standard in communication with the Personal Computer (PC) and has lead to new technologies for interfacing memory devices. These memory/storage devices connect to the USB ports and appear as removable storage device in personal computers, the most popular of which is the USB Flash Drive.The disadvantage of using USB Flash Drives is that it requires a PC to initiate file transfers between one another. As a solution to the USB Flash Drive disadvantage, the project aims to develop a device that allows file transfers between two USB memory devices without the need for a Personal Computer (PC). The USB Slave to Slave File Transfer Device is a device that facilitates file and folder/directory transfers from one flash drive to another flash drive using the USB interface without the need for a Personal Computer (PC) to act as mediator. Figure 1 shows the system setup system. The system allows the user to select files or folders/directories for copying from a source flash drive to a user selectable directory in the destination flash drive. The device also supports a copy all function, which works the same way.

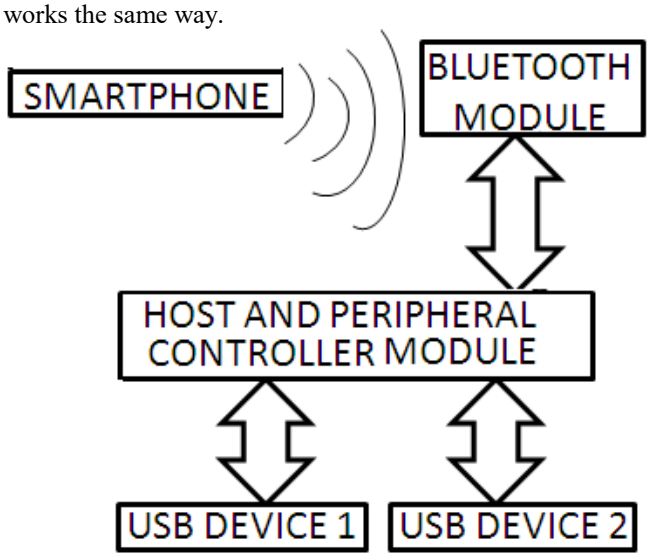


Figure 1: System setup

Contents of the flash drives are displayed in their filename format through liquid crystal display (Smartphone). The system is also able to check for identical file/folder/directory names and requests for a user confirmation to either proceed and overwrite a file/folder/directory or not.

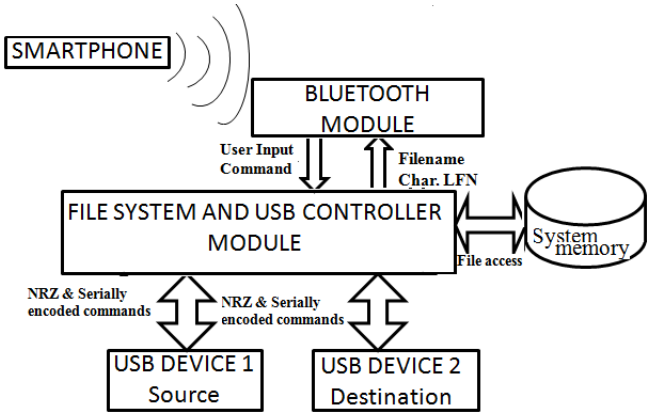


Figure 2: System setup with system memory access.

3. Theoretical Analysis

3.1 User Interface Controller Module

This module is responsible for obtaining user input and displaying user requested information thru an Smartphone. It consists of three sub modules namely the Smartphone Controller, Navigation and Screen Display Formatter User input is received thru this module; however only two out of the six buttons are interpreted and executed within the User Interface Module. These buttons are the "Left" and "Right" navigation buttons whose function are to scroll through the displayed path or Long File Name (LFN) format of a file or directory. The input from the "Up" and "Down" navigation buttons and "Command Buttons 1 and 2" are converted to their corresponding command codes and are forwarded to the File System Controller module for execution. All information to be displayed is received from the File System Controller module.

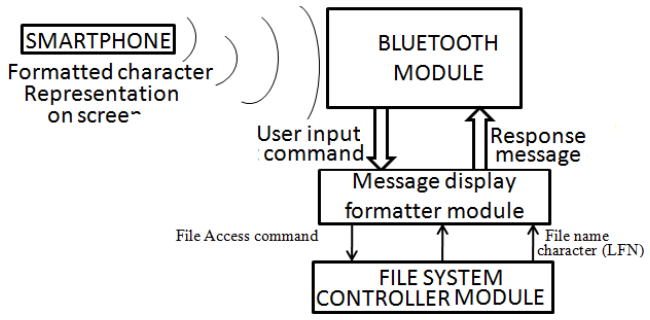


Figure 3: User interface control module

The User interface Controller submodule is the hardware that interfaces the Smartphone to the main hardware system. It is composed of a Smartphone and a microcontroller solely for controlling the Smartphone and receiving user input.

3.2 File System Controller Module

The File System Controller is responsible for all file management processes and FAT file system access for the system. It mediates between the display/user interface and USB communications module. A large percentage of the system's software is found in this module since it contains most of the system's core functions. The major commands handled by the submodule include the "up" and "down" navigation buttons and the different functions attributed to "command button 1 and 2" (i.e., copy, delete, browsing thru files/folders and the back command) File Manager. The File Manager Submodule is responsible for all file management functions/features that are available in the system. These features include copying a file or folder, overwrite, rename, delete, and browsing of the source and destination flash drive.

3.2.1 FAT 32/16/12 Controller

The FAT32/16/12 Controller mediates between the File Manager submodule and the USB Controller Module. It is responsible for abstracting the File System so that the File Manager submodule could easily access the File System be it a FAT 32, FAT16 or FAT12.

3.2.2 USB Controller

The USB Controller module is responsible for starting-up the system, handling the packets, computation and checking of error checking bits, packet encoding, conversion of packets from parallel to serial and vice versa and NRZI decoding and encoding.

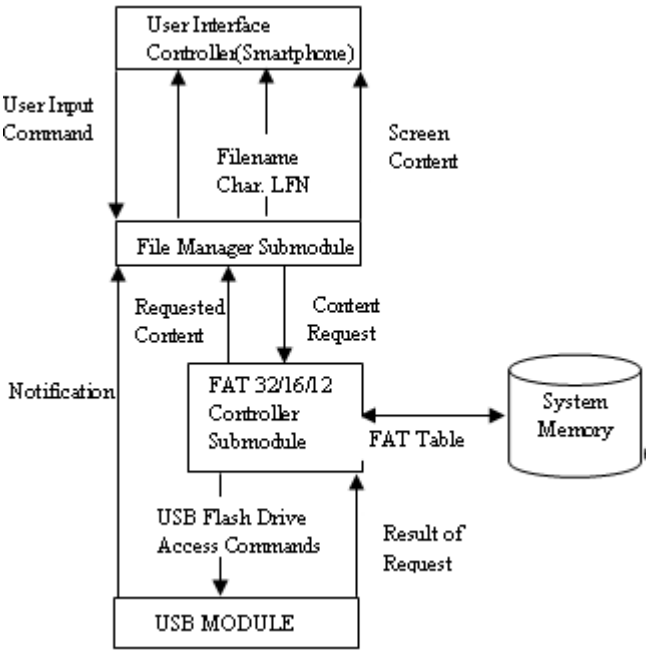


Figure 4: File system control module

This module accepts the commands to either read or write onto a USB flash drive as requested by the *File System Controller* Module. Input from the USB flash drives is the result of an earlier request for data. These requests include content information (i.e. file names), actual content (i.e. files) or identification signals (i.e. the connected USB device is checked if it falls under the Mass Storage Class (MSC) or Human Interface Device (HID)).The module also governs the data that needs to be transmitted to the USB Flash Drives, as well as process and send the results of the transaction to the File System Controller Module. In addition, the module also sends notifications to alert the user of the status of the system or the operation (i.e. the status of a copy or delete command).

3.2.3 USB Host Controller

The USB Host Controller submodule is the main hardware used by both the USB Controller Module and the File System Controller Module. The submodule physically interfaces with the USB flash drives and is responsible for converting raw data and information to their proper NRZI encoding as specified by the USB technical specifications. Furthermore, the submodule is capable of encoding or decoding the incoming NRZI data from the USB flash drives and forwards it to their respective submodules for further processing. The system uses the Vinculam VNC1L, a programmable microcontroller and USB multi-role embedded host/peripheral controller, which has its own Basic Input/Output System and Framework program. Most of the software submodules make use of the available framework where the functions are already abstracted and simply need to be enabled and customized depending on the application.

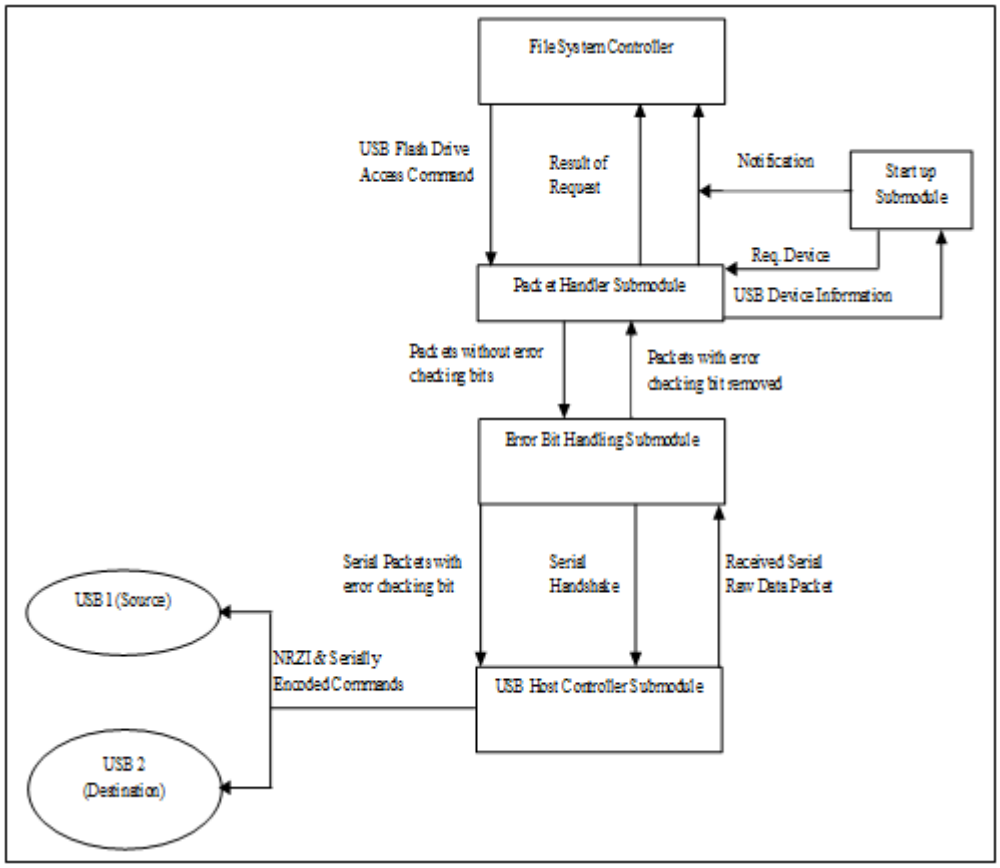


Figure 4: File system control module

3.2.4 Packet Handler

The Packet Handler submodule handles all packet generation and interpretation. The submodule generates packets without error checking bits, which will be used as either data, or command packets depending on the command sent by the File System Controller Module. Requests are interpreted and the error free results and status notifications are sent as output.

3.2.5 Error Bit Handler

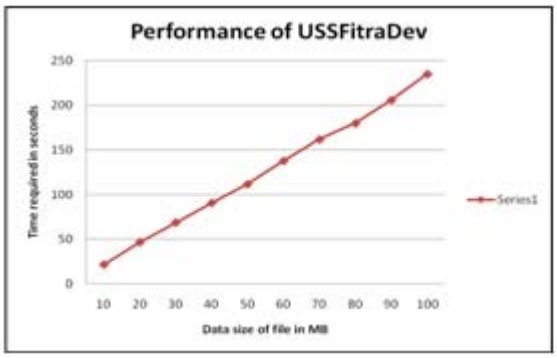
The Error Bit Handling Submodule is responsible for adding error-checking bits to the data about to be sent. Furthermore, the submodule also checks the received packets from the sender flash drive for corrupted data. The submodule forwards an acknowledgement (ACK) handshake in return if the received packet does not contain any errors. Start Up The Start-up submodule handles the system start-up. It deals with the detection of the USB devices attached to the system. The submodule checks the USB ports for USB devices and their properties. For the system to start-up properly, there must be two USB devices attached; the USB devices must fall under the Mass Storage Class (MSC) device class and under the Solid State device subclass; and it must use the FAT 12/16/32 file system. If any of the conditions fail other that the 2 USB device requirements, an error would be used.

4. Results and discussion

Table 1: Performance parameters

Data size in MB	*Time in sec*
10	22
20	47
30	69
40	91
50	112
60	138
70	162
80	180
90	206
100	235

The table1 shows the time required for accessing the file from one device and copy the same from one USB device to the other.From the results it is observed that as the size of file increases the time required for trasnsfering the file data from USB Source to USB destination increases. The table1 is used for plotting the graph of time required in second to transfer the file versus the data size of file in Megabytes.



Graph 1: Performance parameters

5. Applications

1) USB Flash drive to USB Flash drive file transfer interface.
2) Digital camera to USB Flash drive or other USB slave device interface.
3) PDA to USB Flash driver or other USB slave device interface.
4) MP3 Player to USB Flash drive or other USB slave device interface.
5) USB MP3 Player to USB MP3 Player.
6) Mobile phone to USB Flash drive or other USB slave device interface.
7) GPS to mobile phone interface.
8) Instrumentation USB Flash drive or other USB slave device interfacing.
9) Data-logger USB Flash drive or other USB slave device interface.
10) GPS tracker with USB Flash disk storage.

6. Conclusion

USB FiTraDev is a device that facilitates file/ folder/ directory transfers without use of personnel computer as mediator. It can be used as a portable device for various USB devices in absence of personnel computer. It can be operated on AAA battery as well as on AC supply also(by using AC adapter).

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